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THE MARINE AIR COMMAND AND CONTROL SYSTEM:
AN HISTORICAL PERSPECTIVE

by

Richard J. Martin Jr.
Lieutenant Colonel, USMC

A RESEARCH REPORT SUBMITTED TO THE FACULTY
IN
FULFILLMENT OF THE CURRICULUM
REQUIREMENT

Advisor: Lieutenant Colonel William L. Bair

MAXWELL AIR FORCE BASE, ALABAMA

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ABSTRACT

TITLE: The Marine Air Command and Control System: An Historical Perspective.

AUTHOR: Richard J. Martin Jr., Lieutenant Colonel, USMC

Although much has been written about the history of Marine aviation and the Marine ground units it supports, there has been very little written about another important ingredient to this Marine air-ground team, the "glue" that holds it together, the Marine Air Command and Control System (MACCS). The MACCS evolved out of necessity. Along with the modernization of Marine aviation, and its associated complexities, came the need for a system that could provide for air command and control. As is the case with most man-made phenomena, this air command and control system did not evolve overnight. It came about gradually. Its growth was periodically accelerated by wartime demand for the integrated control of ever-increasing numbers of aircraft and missiles (along with their resultant sharing of airspace) and the increasing demand for aviation in direct support of ground forces. The MACCS has had a long and colorful history and has played a pivotal role in keeping Marine air in support of Marines.

BIOGRAPHICAL SKETCH

Lieutenant Colonel Richard J. Martin Jr. (B.S., University of Maine) is an air support control officer. In twenty-one years of service, he has spent over fourteen years directly in air command and control billets in all three Marine aircraft wings. He is a graduate of the USMC Advanced Communications Officer Course and USMC Command and Staff College. He was the course director for the Tactical Air Control for Amphibious Operations Course at Landing Force Training Command, Atlantic Little Creek, Virginia and also served in the G-3 of the 2d Marine Expeditionary Force as the air control officer and NATO action officer. Between 1989-93, Lieutenant Colonel Martin served as the Executive Officer of Marine Air Support Squadron 1 (MASS-1), Cherry Point, North Carolina; as the MASS-1 Detachment Commander, 4th Marine Expeditionary Brigade, during *OPERATIONS DESERT SHIELD* and *DESERT STORM*; as Commanding Officer of MASS-1, and as 2d Marine Aircraft Wing Deputy G-6. He was selected, in 1983, as Marine Air Control Officer of the Year; and, in 1992, his squadron was honored as Marine Air Command and Control Unit of the year. Lieutenant Colonel Martin is a graduate of the Air War College, class of 1994.

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CHAPTER I

INTRODUCTION

Marine aviation, when compared with the history of the United States Marine Corps in general, is relatively young but has a rich and colorful history all its own. Marines such as Cunningham, Rowell, Geiger, Turner and other pioneers nurtured it through its early years. Its organization evolved and its mission and tactics developed commensurate with the development of the modern aircraft. Along with this modernization and its associated complexities came the need for a system that could provide for the command and control of these aircraft (and missiles), as well the airspace in which they flew, in order to provide the degree of support required by Marine Corps warfighting organizations--the Marine Air-Ground Task Forces (MAGTFs). On more than one occasion, it has been said that the Marine Corps' ability to manage its own airspace, defend it, and fight in it is the very underpinning of the MAGTF.

As is the case with most man-made phenomena, this air command and control system did not develop overnight. It came about gradually. Its growth was periodically accelerated by the wartime demand for the integrated control of ever-increasing

numbers of aircraft (along with the resultant sharing of airspace) and the increasing demand for aviation in direct support of ground forces. Although much has been written about the exploits of Marine pilots in support of these ground forces, very little has been written about the evolution of the organizations that directed these pilots during these exploits. This perspective will illustrate just how the Marine Air Command and Control System (MACCS) began and how it has evolved into the vital role it plays in today's Marine Corps.

CHAPTER II

THE EARLY YEARS

Early military use of aviation, which began shortly before World War I, consisted primarily of aerial observation. As the value of the airplane as a weapons system was realized, the functions of antiair warfare and close air support became options. Antiair warfare, in those early days, consisted of individual "dogfights" between pilots armed with pistols who flew close enough to each other to take a wild shot or to shout obscenities but do little other harm. As the war progressed, aircraft armed with both fixed and free machine guns were able to inflict considerably more damage, and squadron tactics replaced individual tactics. In an attempt to control these groupings of aircraft, a system of hand signals was devised, providing limited air-to-air communications. These hand signals enabled the pilots to direct each other through the skies well enough, but there was no means of providing additional direction and warning information to the aircraft from the ground once they took off.

The incorporation of radio led to improved methods of employing aircraft in a defensive role. Concepts such as airborne early warning, fighter control, and combat air patrols

(CAP) would eventually become routine. Still to come would be the incorporation of the radar which, along with the radio, would ultimately serve as a catalyst for "systemizing" antiair warfare command and control--an event which would not occur, however, until World War II.

The idea of providing air in close support of ground forces is a more recent development. Marine air played a significant role near the end of World War I in what would now be called deep air support, air reconnaissance, assault support (logistics resupply), and, as we've mentioned, antiair warfare. Except in isolated instances, however, close air support was virtually nonexistent. The use of aviation in close support of troops actually began in the late 1920's during the "Banana Wars" in Nicaragua where Marine airplanes, employing dive bombing techniques, flew missions in support of ground troops against the Nicaraguan rebels. Most of these missions were prebriefed. Nonetheless, some rather innovative thinking was employed for processing air support requests.

Our air-ground communications were quite simple and dependable in those halcyon days before radio, radar, and IFF. We simply flew out over the area where our small columns were operating, spotted panel signals, referred to our code cards for interpretation, zoomed down to trail our pick up "fish" across a message line hung on two poles, then flew off to do whatever odd chore a dirty, bearded, and harassed column commander might have devised for a cocky young birdman who slept in a clean bed every night and used ice in his whiskey (l:13).

As with antiair warfare, there would not be a more refined system in place until World War II.

Soon after the Marine Corps undertook its amphibious role, Marine aviation reorganized to support the Fleet Marine Force (FMF) in landing operations and troop activities in the field as well as to provide replacement squadrons for carrier-based naval aircraft. Inherent in this mission (although not fully realized at the time) would be the necessity for Marine aviation to provide for its own air command and control and to coordinate its activities with those it would support. The specific functions of antiair warfare and close air support would receive added emphasis. It would soon become painfully evident that the need to defend the vulnerable landing force by gaining and maintaining air superiority, coupled with the need to provide timely close air support to ground forces, would be vital to the success of any amphibious operation.

CHAPTER III

WORLD WAR II

The advent of World War II would accelerate the Navy-Marine Corps development of an amphibious air command and control system. Through trial and error in the early days of the Pacific war, a system was developed that provided for air command and control to initially remain afloat under the jurisdiction of the senior commander (usually the amphibious task force commander) until passed ashore to the landing force commander. This system would provide for centralized command and decentralized control both afloat and ashore and would permit the amphibious task force commander to incrementally phase air command and control ashore as soon as the situation would allow.

As previously mentioned, the necessity of gaining and maintaining air superiority was extremely vital--so much so, in fact, that close air support initially took a back seat. During World War II, ground forces on all fronts would realize the devastation that could be wrought by aircraft delivered ordnance. Moreover, although the ability of our fighter aircraft to protect these ground forces during the hours of daylight was excellent, the problem was protecting these same forces during the hours of

darkness. Before radar, the only means of protection for ground forces from this threat was antiaircraft artillery--which in those days consisted of searchlights and guns of varying calibers. The timely development of radar by the British and its subsequent incorporation into Marine aircraft and ground stations would significantly enhance the Marines' ability to defend themselves on a 24-hour basis.

The initial concept for employing radar in the Marine Corps came in the form of the night-fighter squadrons (VMF[N]).

...Headquarters Marine Corps, in late 1942, turned to Britain's Royal Air Force (RAF) for help in training a cadre of Marine Corps personnel in all aspects of their radar systems and air-to-air intercept tactics. The Royal Air Force was a wise choice because of the expertise it had built up in these types of tactics during its defense of the British Isles against the German Luftwaffe. To the best of my memory, this group consisted of five Marine aviators, three Marine ground officers, and five Marine enlisted personnel...(Upon completion of training) most of the group proceeded to Marine Corps Air Station Cherry Point where all hands joined in training personnel of VMF(N)-531 for deployment to the South Pacific as the pioneer night fighter squadron (2:68-72).

These squadrons consisted of radar-equipped aircraft and ground-based radar with which to conduct ground controlled intercepts (GCI). They were trained as teams (as indicated above) at Cherry Point, North Carolina, and deployed to support operations in the Gilbert, Marshall, Marianas, and Ryukyu Islands as well as other operations in the South Pacific. This was the birth of GCI in the Marine Corps; the GCI controllers who manned these radars set the standard for those who would follow.

Here was a new, highly complex operation which involved not only the aircraft and its crew but also the controller on the ground whose task it was to direct the airman by means of radar to an interception point where the plane's own radar could seek out the foe so its guns could shoot him down...a controller was required whose skill had to be as decisive as that of the man flying the plane (3:158).

Antiair warfare command and control was becoming more complex. There was a need for a more sophisticated system which would not only encompass the new technology but also provide for the integration and deconfliction of air-to-air weaponry with surface-to-air weaponry. This concept would be realized with the inception of the Air Defense Command (ADC) just prior to *OPERATION ICEBERG*--the battle for Okinawa.

The ADC was established under the Tactical Air Force (TAF), Tenth Army, which provided all land-based air support during the battle for Okinawa. This was done in order to provide the landing force with the means to assume antiair warfare command and control ashore. The ADC was tasked with the following (4:3):

- Establish a headquarters and an Air Defense Control Center (ADCC) ashore as soon as possible after LOVE day (target day).
- In conjunction with fleet aircraft present, furnish direct defense of the area against enemy air operations by the execution of assigned missions.
- Furnish escort aircraft as directed.
- Furnish fighter aircraft for offensive missions as directed.
- Assume control of air defense including AA and searchlights on order.

Although these tasks imply the command and control of both

antiair warfare and close air support, the primary emphasis was the protection of the landing force from kamikaze attack--a mission that would demand its full attention.

In order for the ADC to conduct its mission, it needed fighter aircraft and an early warning radar network to provide surveillance. The ADC would eventually consist of four Marine fighter groups (with three night fighter squadrons) and three Army fighter squadrons (with one night fighter squadron). The GCI controllers in the night fighter squadrons were reorganized under an air warning group (forerunner of the Marine Air Control Group) and further subdivided into five Marine air warning squadrons (AWS). These air warning squadrons were normally equipped with two long range and three short range radars and were deployed to various sites around the main island. They were given the tasks of warning of the approach of enemy aircraft; controlling interception by friendly aircraft; receiving, collating and disseminating all information on aircraft within their assigned sector to the ADCC; assisting in air-sea rescue; and vectoring home lost aircraft.

The air warning squadrons played a vital role in the defense of Okinawa and would continue to play an important role in the future of the MACCS as the predecessors of the modern day Marine Air Control Squadrons (MACS). As a footnote, AWS-1 (now MACS-1) would record 36.5 daytime intercepts and 26 nighttime intercepts between May and August 1945, which was the highest total recorded by any single air warning squadron during the battle. In

addition, AWS-7 (now MACS-7) would get credit for successfully repelling a Japanese counterlanding at Hedo Point in northern Okinawa (3:403 & 449).

In the meantime, the war accelerated the development of another aviation function--close air support. Although the effect of close air support on the morale of friendly troops was great, initial close air support command and control techniques were crude and communications unsatisfactory.

Marine pilots gained some experience with close air support during the intervention in Nicaragua, and apparently these officers considered Marine aviation solely as a supporting arm of Marine Corps ground troops. Before the war, however, the Marines had not developed any particular techniques, organization, or communications for close support work. It would be late 1943 before Marine units began to train specifically for such operations, and 1945 before they would undertake close air support as a primary mission. In the Pacific they performed exceptionally well in the role (5:15-16).

As is implied in the preceding passage, training and hardware would eventually be refined in various operations from the Guadalcanal to the island of Iwo Jima. However, as was the case with antiair warfare, the full potential of close air support would not be realized until the battle for Okinawa.

The mechanism in place ashore to facilitate close air support consisted principally of two agencies--the Air Liaison Parties (ALPs) and the Landing Force Air Support Control Units (LFASCUs). These units were first used during the invasion of the Gilbert Islands in 1943. The concept of ALPS was first initiated out of the experiences and results gained in North Africa and the needs demonstrated at Guadalcanal. By the time

the battle of Okinawa was fought, there would be 13 ALPs assigned to a division to be parceled out at the division, regiment, and battalion level. Their purpose was to advise supported commanders as to the best use of allotted aircraft, to request air support through appropriate channels, and to control the aircraft once it arrived.

In order to process air support requests, provide more timely response, and coordinate supporting arms, three LFASCUs were organized and deployed ashore with Tenth Army Headquarters, XXIV Corps, and III Amphibious Corps. After the first five days, these LFASCUs assumed close air support control ashore from the Navy's Tactical Air Control Center (TACC). Between 5 April and 30 June 1945, they coordinated and controlled 10,506 sorties (3:408). As a direct result, close air support was employed more efficiently than at any other time in the Pacific. The system in place to command and control close air support during the battle for Okinawa formed the basis for the present organizations. The Air Liaison Parties (ALPs) are now referred to as Tactical Air Control Parties (TACPs) while the Landing Force Air Support Control Units (LFASCUs) are now referred to as Direct Air Support Centers (DASCs).

Another development of the Pacific campaign came with the realization that the landing force needed a centralized command element which would oversee the integration of antiair warfare with close air support. Additionally, this agency would serve as the command post of the tactical air commander (ashore). The

Navy already had an agency in place that served this function in the previously mentioned TACC located on the amphibious task force commander's flagship. The establishment of an equivalent landing force agency, however, would be somewhat more complex. On Okinawa, the Tactical Air Force (TAF), Tenth Air Force, under the command of Major General F.P. Mulcahy, USMC, established a TACC, of sorts. The TACC consisted of TAF headquarters, the ADCC, and LFASCU #3. From this consolidation came the centralized command of landing force aviation and the predecessor of the modern day Marine Tactical Air Command Center (TACC).

Marine Corps air command and control made great strides during World War II, evolving from virtual non-existence to a system distinctly similar to the present MACCS. In addition to air defense and close air support, it is also important to mention three other aspects of the MACCS that would see accelerated development during the war--surface-to-air weaponry, air traffic control, and ground-controlled bombing.

Adaptation of aircraft to military purposes during the early 1900's naturally stimulated the development of special weaponry with which to shoot them down. In the early stages of aircraft development, use of organic, hand-held weapons was sometimes adequate; however, as airplanes began to fly at higher altitudes, guns of artillery caliber were needed. During the latter part of World War I, special mounts were constructed to allow guns adapted for antiaircraft (AA) to shoot skyward. Height-finding equipment and the means to determine "leads" were developed along

with high caliber weapons; giant searchlights were also incorporated to search the skies at night. The result was the formation of units equipped with a mixture of light, medium, and heavy guns to defend against airplanes coming in at low, intermediate, or high levels.

Within the Marine Corps, these surface-to-air weapon units were organic to ground forces and were initially organized as defense battalions. These defense battalions varied slightly in weaponry but basically consisted of individual batteries of 3" AA guns, .50 cal. guns, 20MM guns, 40MM guns, 90MM guns, searchlights and sound locators, in addition to coastal artillery. These units were employed throughout the Pacific theater in such places as Pearl Harbor, Wake Island, Midway, Guadalcanal, Northern Solomons, Bougainville, the Marshall Islands, and Okinawa (6:LAAMBn). Treated as a separate entity at the war's beginning, their utilization would be coordinated under the ADC concept by war's end.

As the position finding precision of radar grew, it was discovered that a ground controller could direct aircraft accurately into a desired position in relation to ground targets. Two developments were to result from this discovery and both would impact on the evolving capabilities of the MACCS. The first was the development of a system which provided landing guidance to aircraft during periods of reduced visibility and the second was the development of a ground-controlled bombing system.

Air traffic control would receive a boost during World War

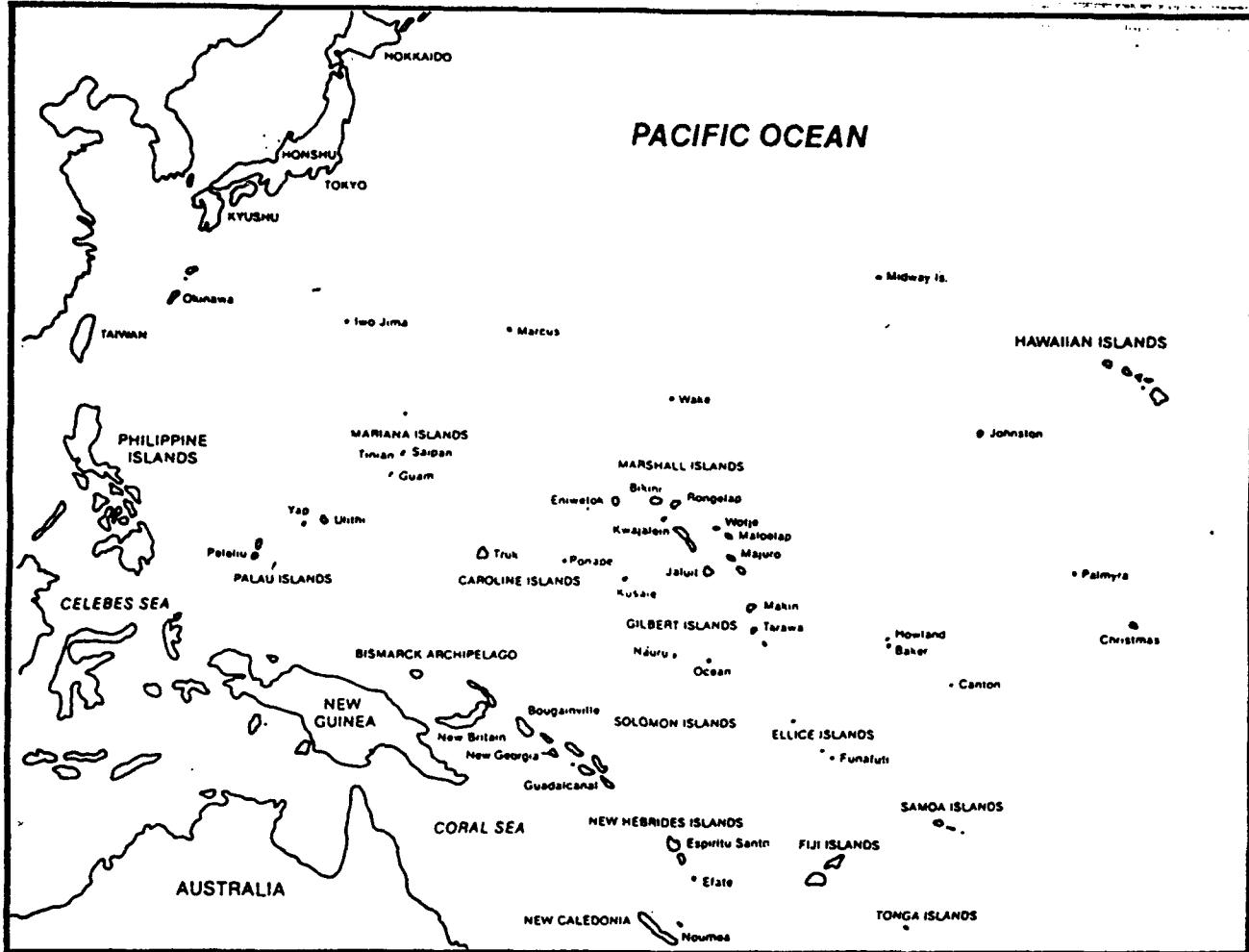
II with the development of a special high-precision ground-controlled approach radar (GCA). Although this emerged from production rather late in the war, it was used with success in the Pacific theater. This would be a far cry from the old system in place at the beginning of the war, when tall wooden towers manned by controllers armed with binoculars and radios were established at Pacific airfields to control the approach and departure of friendly aircraft. With GCA and search radar, Marine air traffic control would evolve and eventually become part of the present MACCS as Marine Air Traffic Control Squadrons (MATCS).

The development of ground-controlled bombing began in the European theater when weather interfered too much with Allied bombing. Considerable success was achieved by controllers of the Army Air Corps' Air Support Parties (ASP), who, with suitably modified ground-based radars, provided course and release-time instructions to aircraft as they passed over their target. This technique would be adopted by the Marine Corps and would result in the development of air support radar teams prior to the Korean conflict.

Post-war reorganization of Marine air command and control would see several changes. The Marine Air Control Group (MACG) would be formed. In keeping with the now adopted doctrine of centralized command and decentralized control (at least within the Navy and Marine Corps), Marine air command and control units such as the Tactical Air Command Center (TACC), the Air Defense

Control Center (ADCC), the Landing Force Air Support Control Units (LFASCUs) and the Air Warning Squadrons (AWS) were consolidated under this MACG concept. Plans provided for one MACG to support Fleet Marine Force Pacific (FMFPac) and one MACG to support Fleet Marine Force Atlantic (FMFLant), each providing the necessary liaison between their respective wing and division elements. This reorganization would prove to be timely. Within three years, Marine air command would once again be put to the test--this time in Korea.

As an interesting footnote to the period between World War II and Korea, further use of Marine air warning squadrons was made when AWS-11 and AWS-7 (predecessors of MACS-2 and MACS-7 respectively) were deployed to China. They were employed to support the repatriation of foreign nationals and the occupation of northern China. AWS-11 was employed at Tsingtao from October 1945 until May 1946 while AWS-7 was employed at Nan Yuan from October 1945 until January 1949 (6:MACS).



CHAPTER IV

KOREA

Korea would prove to be a much different scenario as far as Marine participation was concerned. Marine ground units would come under the control of the Eighth United States Army while Marine aviation units would ultimately come under the control of the Fifth Air Force. Whereas arrangements of this sort were commonplace during World War II, between wars each service (including the newly autonomous USAF) went home and wrote separate doctrinal manuals--including those pertaining to close air support. The Air Force was initially unprepared to conduct close air support.

...the Air Force experienced considerable difficulties in interfacing with Army ground forces. Air Forces in the Far East at the onset of hostilities were built around air defense and light bomber squadrons. There were no plans that required support of Army troops in combat (7:28).

The fundamental difference (in doctrine between the Air Force, Navy and Marine Corps) had its roots in different conceptions of the proper role of air power, different training and equipment that flowed from those conceptions, and different employment practices that were shaped by the capabilities and limitations of the equipment and aircrews available (7:36).

For operations in Korea, the Fifth Air Force operated under a doctrine that insisted on a system of centralized command and

control of air. This system had supported Air Force requirements in Europe and North Africa.

The geography of the plains of North Africa and Europe and the ideology of independent air power had made that "inherent flexibility" of which enthusiasts prate macro-flexibility. For the conduct of the air campaign, control was centralized at the highest possible level and preplanned operations were the rule, with the result that while a large effort could be switched from day to day along an extensive battle front, control at the target had been neglected. The Navy and the Marine Corps, by contrast...tended to rely on doctrine supplemented by brief orders, and on delegation of control to those on the spot. Provision of tactical aviation in ground warfare was looked upon as a service to the forces involved rather than as a part of a separately controlled campaign (8:387).

This system would draw considerable fire from all sides. Marines were very sensitive to working within a system that was perceived as being unresponsive in supporting Marines on the ground.

The Fifth Air Force system called for all air operations to be managed and controlled at the Tactical Air Control Center (TACC) under the auspices of the Joint Operations Center (JOC). Forward Air Controllers (FACs) were assigned to the U.S. Army and to British units down to the regimental level as well as to Republic of Korea (ROK) at the division and corps level (9:17). Even the most urgent requests had to be channeled through each echelon to the JOC for approval. This was neither timely nor supporting of ground maneuver. Statistics kept by the Navy and Marine Corps during a representative time period reflect that delays as great as 80 minutes had been experienced (35 minutes to process requests through the JOC). Only 60-70% of the sorties requested ever flew (9:135).

As it would turn out, the Air Force agreed to a different

arrangement with the Marines.

While supporting the Marine brigade, the Marine airmen did not report to the Joint Operations Center, but at General Partridge's (Fifth Air Force) request the 1st Marine Aircraft Wing sent a liaison officer to join the Air Force combat operations section (in the JOC). During those intervals when the Marine brigade was not in action, the Marine Aircraft Group furnished its Corsair capabilities to the Joint Operations Center for the support of the entire Eighth Army battleline (10:121).

During the Korean conflict, it would be proven repeatedly that Marines were more than aptly suited to command and control their own air--particularly close air support. Between wars their command and control agencies had honed skills learned from World War II and were prepared to function when the conflict began.

The units that made up Marine Air Control Group-2 (MACG-2), in support of operations in Korea, were Marine Ground Control Intercept Squadrons-1 and 3 (MGCIS-1 and 3) (formerly AWS-1 and 12 respectively) and Marine Tactical Air Control Squadron-2 (MTACS-2). MTACS consisted of an air defense section and two air support sections. It provided personnel and equipment for the Marine Tactical Air Command Center (TACC) (or when operating subordinate to the USAF's theater Tactical Air Control Center [TACC], a Tactical Air Direction Center [TADC]). One of the air support sections from the MTACS functioned as a LFASCU (vintage World War II) and deployed in proximity to supported ground unit(s).

Both the MGCIS and the MTACS were frustrated by the centralized Air Force system but were able to function within its

confines providing outstanding GCI and early warning support as well as close air support to ground units. These units participated in operations in the Pusan perimeter, Chosin Reservoir, Inchon-Seoul, the East Central Front, and the Western Front. They would also remain to help preserve the peace in the months shortly after the armistice (6:MACS).

It's interesting to note that during the Korean conflict new and innovative ideas were put to the test in the form of an airborne Tactical Air Direction Center (TADC) and the Marine Air Support Radar Teams (MASRT). The airborne TADC (forerunner of today's airborne Direct Air Support Center [DASC]) was created as a means of providing close air support coordination when terrain made it impossible to coordinate it otherwise. The airborne TADC, consisting of an R5D aircraft from VMGR-152 configured with a few extra radios, proved its worth during the Chosin Reservoir operation and the subsequent withdrawal. It controlled and coordinated 869 aircraft on 211 missions for six days, averaging more than ten hours in the air daily (6:MASS).

As mentioned previously, ground-controlled bombing was being developed towards the end of World War II in the European theater. In the interim between World War II and Korea, the Marine Corps took a special interest in developing its own system. Developed and hand-built by Marines, the AN/MPQ-14 was introduced into the Korean theater in September 1951. Initially, considerable mechanical difficulty was experienced which affected the accuracy of the bombs, but later the system became

sufficiently reliable to permit bomb drops within one mile of friendly lines. By the middle of summer 1952 the Marines had obtained Fifth Air Force permission to use radar bombing, controlled by a forward observer on the ground, in a close support role (11:62-63).

Marine antiaircraft artillery units also participated in the Korean conflict and were represented by the 1st 90MM AAA Gun Battalion and the 1st Provisional Antiaircraft Artillery-Automatic Weapons Platoon. Their primary mission was to protect airbases. Marine air traffic control had also formed into Ground Control Approach Units (with the recently developed GCA radar) and provided ground control approach services for their supported aircraft groups.

By now a system for Marine air command and control had established itself. Over the next several years it would undergo more reorganization before it reached its next challenge-- Vietnam.



CHAPTER V

THE POST-KOREA--PRE-VIETNAM INTERLUDE

The 12 year respite between Korea and Vietnam produced a flurry of activity in Marine air command and control. Reorganization and technological development characterized the times. In terms of reorganization, several changes would occur. By February 1954 both the Marine Ground Control Intercept Squadron (MGCIS) and the Marine Tactical Air Command Squadron (MTACS) had changed to Marine Air Control Squadron (MACS) and Marine Air Support Squadron (MASS), respectively, and by 1956 the functions of the Marine Air Control Group (MACG) had been absorbed by the Marine Wing Headquarters Group (MWHG).

Within these organizations would be further reorganization. The three MACS in each wing would each provide and operate facilities for a Counter Air Operations Center (CAOC). The CAOC would be the agency providing decentralized control of air defense for its assigned sector on the battlefield. The single MASS in each wing would no longer have an air defense section but would provide facilities for a Direct Air Support Center (DASC) and three Air Support Radar Teams (ASRT) (12:1-6). The DASC would provide the wing commander with the capability to

decentralize the control of offensive air support and would collocate with the infantry's senior Fire Support Coordination Center (FSCC) for the purpose of coordinating aviation with other supporting arms. The ASRTs would provide day or night, all-weather ground-controlled bombing capability.

The MWHG was an attempt to administratively consolidate the wing headquarters element with the air control group headquarters. Additionally, the MWHG contained a Headquarters and Headquarters Squadron (H&HS) and a wing communications and electronics element. By 1967 Marine Wing Headquarters Squadron (MWHS) would form and the MACGs would re-form. Part of the H&HS would split off and come under the MACG while the wing communications and electronics element would reorganize as the Marine Wing Communications Squadron (MWCS) and also come under the MACG. H&HS would provide the personnel and facilities to handle administrative matters for the MACG and would also be responsible for manning the wing commander's Tactical Air Command Center (TACC) from which he could centrally command the employment of his forces. The MWCS would be responsible for ensuring communications connectivity between air command and control agencies and to higher and adjacent agencies. The Ground Control Approach Units would reorganize into Marine Air Traffic Control Units (MATCUs) and would remain organic to the Marine aircraft groups (MAGs) (both fixed wing and helicopter). The most dramatic reorganization, however, would come in the surface-to-air weapons organizations.

The reorganization of surface-to-air weapons would parallel the technological changes occurring during this period. Gun systems such as the 3" AA gun, the 20MM, .50 cal., the 75MM Skysweeper, the M-42 Duster, the 90MM, etc., grew into the Terrier and then to the Hawk missile systems. Organizationally, these units evolved from antiaircraft artillery battalions into medium antiaircraft missile battalions during the mid-fifties; by the mid-sixties, they would evolve into light antiaircraft missile battalions (LAAMBN). These units would belong to Force Troops (FMFLant/FMFPac) until the early sixties after which they would be incorporated into the wing structure under the MACG.

Another major technological change would impact on Marine air command and control during the 12-year stretch from 1953 to 1965--the development of the semi-automated air control system. This system, the Marine Tactical Data System (MTDS), had been under development since the late fifties and was compatible with two other similar developments by the Navy: the Navy Tactical Data System (NTDS) and the Navy Airborne Tactical Data System (ATDS) for airborne control centers (13:138). These systems would allow for the rapid transmission of information between compatible Navy and Marine units. This would greatly facilitate the ability to warn each other in real-time or near real-time fashion. Today, virtually all U.S. forces are capable of accomplishing this feat, as are some of our allies (NATO and Korea in particular).

In October of 1962, during the Cuban missile crisis, Marine

air command and control units, plus a battery from 2d LAAMBn, were deployed to Guantanamo Bay, Cuba. Among the air control units present were MACS-6 and MASS-1 and elements of MASS-3. MACS-6 provided surveillance and air defense control. MASS-1 provided a DASC for offensive air support control and an ASRT featuring the first operational AN/TPQ-10 all-weather ground-controlled bombing system. Elements of MASS-3 stood by in the Caribbean to be used if needed, and 3d LAAMBn relocated to Cherry Point, North Carolina, as a standby unit (3d LAAMBn would relocate there permanently in 1963). Earlier, in May 1962, MACS-4 deployed to Thailand in connection with the communist threat to that country. It would remain there until July 1962.

The previously mentioned AN/TPQ-10 was the next generation ground-controlled bombing system developed by the Marine Corps. It replaced the Korean vintage MPQ-14 and allowed for properly equipped aircraft to be controlled and bombs to be released by the system with the pilot flying hands-off.

The interlude after Korea was a busy one; there would be more to come. Vietnam would be the first big test of the effectiveness of what was now known as the Marine Air Command and Control System (MACCS).

CHAPTER VI

VIETNAM

Long before the 9th Marine Expeditionary Brigade (MEB) landed in Vietnam, the matter of centralization of theater air command and control had to be resolved. Air Force leaders argued that control of air in Vietnam (to include helicopters) should be centralized under the Seventh Air Force. They felt the fragmentation of tactical air forces into small packages was inefficient and expensive. Marines, interpreting this philosophy as an Air Force grab for control of the Marine air component, rejected the idea under the same grounds of inefficiency. Eventually an agreement was reached in regards to air defense coordination between the 1st Marine Aircraft Wing (MAW) and Seventh Air Force. Under the terms of agreement the Air Force was responsible for the air defense of South Vietnam. The memorandum of agreement gave the Air Force scramble authority for Marine alert fighters, and the authority to designate targets and to declare USMC Hawk missile control status (7:46).

What seemed to be easy for the air defense function, however, was anything but for the function of supporting ground forces. Although most of the disagreement was doctrinal, part of

it dealt with the perception among senior Marines that the Air Force was (once again) unprepared in terms of equipment and doctrine for the support of ground troops at the onset of conflict while (in the Marine view) trying to "take over" a function for which they were allegedly unsympathetic and unprepared--all under the guise of unity of command (7:46).

As Commander in Chief, Pacific (CincPac), Admiral H.D. Felt convened a board of 12 senior officers with representatives from the three component services and the CincPac staff. The board looked at the full spectrum of tactical air support, which included control, antiair warfare, offensive air support, reconnaissance, and transport, and arrived at a number of conclusions. That all services had aircraft and required them for their tactical mission was one of the conclusions. Another was that the Joint Force Commander could appoint one of his component commanders as coordinating authority for tactical operations. This "coordinating authority," as the direct representative of the Joint Force Commander, had only the authority to require consultation between services but did not have the right to compel agreement--that authority would rest only with the Joint Force Commander. This would serve to provide a forum for arbitration amongst the services in disagreement.

The results of this board were never signed by either Admiral Felt or his successor Admiral U.S.G. Sharp; however, in subsequent battles between Commander U.S. Military Assistance Command Vietnam (ComUSMACV) and CincPac over control of Marine

aviation, these principles were generally applied in favor of the Marines. The Marine Corps would never lose operational control of its aviation during Vietnam (13:134-138 and 14:9-10). With that foundation laid as a starting point, the MACCS was ready to do business.

The MACCS that would support forces in Vietnam consisted of the Tactical Air Command Center (TACC), which provided centralized command for the Tactical Air Commander; a Tactical Air Operations Center (TAOC) (renamed from CAOC), for antiair warfare control; and a Direct Air Support Center (DASC), for decentralized control of direct air support. The TACC was established in June 1965 in the 1st MAW compound at Da Nang and functioned there for the duration of its time in-country. The first TAOC element was deployed in May of 1965 when MACS-9, located in Atsugi, Japan, was directed to provide an early warning radar team at Phu Bai. Within 24 hours of being notified, the team was flown in to operate as the northern radar site for the Air Force radar station "Panama" on Monkey Mountain. The remainder of the squadron deployed to Chu Lai and established a manual TAOC. MACS-7, recently deployed to Okinawa from Cherry Point, North Carolina, relieved MACS-9 in place in September 1965 (6:MACS).

In the manually configured TAOC, the information from various radars was plotted by hand on vertical display boards, just as it had been done in World War II and Korea. In June 1967, MACS-4, from Camp Pendleton, California, arrived in Vietnam

and brought with it a modern, semi-automated, computer-oriented TAOC. With the addition of a component called the Tactical Data Communications Central (TDCC), the TAOC would now have the capability to handle up to 250 aircraft tracks, friendly and hostile, at one time. From an air defense point of view, the controllers could control more than 25 intercepts simultaneously. The TAOC also had a built-in missile data link capability (13:138). This would prove to be a far cry from what had been in existence for many years. Antiair warfare had finally come of age!

As a result of a joint task group study, it was recommended that steps be taken to link the Navy, Marine Corps, and Air Force air command and control systems together in order to pass correlated air situation information. This interface became operational in August 1969 and would set the stage for future operations.

On 8 February 1965 one of the first ground units in Vietnam, 1st LAAMBn, arrived and set up at Da Nang airfield. In September 1965 2d LAAMBn arrived in-country and established itself at Chu Lai. Both battalions set up their own Antiaircraft Operations Centers (AAOC) and interfaced with the Air Force Control and Reporting Center (CRC) on Monkey Mountain for antiair warfare control and coordination. The various batteries and assault fire units of these battalions were located in various locations such as Hai Van Pass, Hill 55, Hill 141, and Ky Hoa Island so as to protect the vital areas along the projected threat axis.

Although they never fired a shot in anger, they were considered a formidable deterrent to the enemy. Before the conflict was over, 2d and 3d LAAMBns would be incorporated into the MACG while 1st LAAMBn would be deactivated on 30 November 1970 (6:LAAMBn).

After arriving in-country in April 1965 and October 1965, respectively, MASS-2 and MASS-3 immediately went to work. They were tasked with providing three DASCs. Initially, one DASC supported each Marine division, but because of its large area the 3d Marine Division would have an additional DASC located at its forward command post. These DASCs were collocated with each division's Fire Support Coordination Center (FSCC) in order to facilitate the coordination of supporting arms. Airborne DASCs, installed in a KC-130 aircraft, were also used to extend communications and to circumvent terrain masking. The MASSs supported virtually every major Marine combat operation in Vietnam from 1965 to their departure in 1971 and provided task organized airborne and ground-based DASCs at places like Da Nang, Camp Horn, Dong Ha, Khe Sanh, Phu Bai, and Vandegrift (to mention a few) (6:MASS).

As part of the MASS and subordinate to the DASC, the Air Support Radar Teams (ASRTs) were extensively used in support of division elements. These teams with their AN/TPQ-10 bombing system, were to prove their worth on numerous occasions by providing an all-weather, day or night, ground-controlled bombing capability. As an example of this capability, an FMFPac report stated that during the worst of the monsoon season in I Corps,

from October to December 1966, the five teams in operation at the time controlled 4,993 sorties representing 31% of all combat sorties flown by Marine aircraft (15:269).

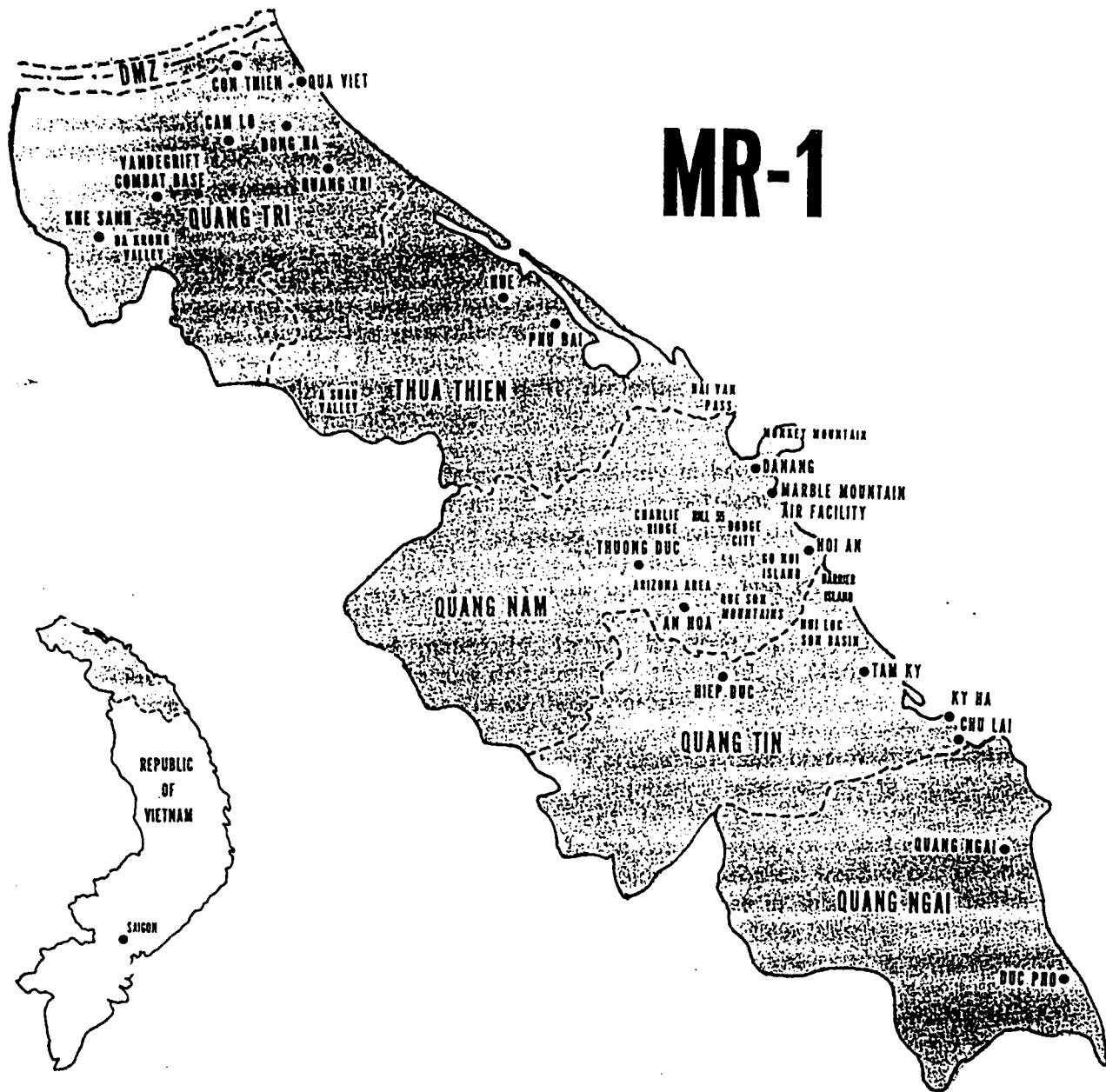
Operating from sites such as Chu Lai, Da Nang, Phu Bai, Dong Ha, and Pleiku, these teams were quite active (6:MASS). Using only MASS-3's ASRT figures as an example, from November 1966 to May 1971, ASRTs directed more than 38,010 AN/TPQ-10 missions which placed in excess of 120,770 tons of ordnance on more than 56,753 targets (6:MASS-3). The AN/TPQ-10 so impressed Lieutenant General Moore of the Seventh Air Force that he initiated a program to develop a similar system for the U.S. Air Force.

Although not a part of the MACCS at the time, the Marine Air Traffic Control Units (MATCUs) played a vital role in controlling traffic in Vietnam. Their role was to provide approach control, ground-controlled approach (GCA), and tower facilities. They were still organic to the individual aircraft groups (one per fixed-wing group and two per helicopter group) but were tied electronically into the TAOC in order to hand-off aircraft from one another in a positive air control environment. The MATCUs provided services at such places as Chu Lai, Marble Mountain, Baldy, Phu Bai, Khe Sanh, Quang Tri, Dong Ha, and An Hoa (14:8).

As the MACCS phased out of Vietnam in the early seventies, it could look back upon a period of steady growth. It had entered the conflict as a manual system and left it as a semi-automated, computer-oriented system--clearly the leader in joint tactical interface. The MACCS also came out of Vietnam with an

increased measure of respect, earned for the role it had played
in providing that vital link between the Marine air-ground team.

MR-1



CHAPTER VII

POST-VIETNAM TO OPERATION DESERT SHIELD

In the years following Vietnam, the role of Marine aviation in support of Marines on the ground would receive a doctrinal "boost" with the publication of LFM-04 *Doctrine and Procedures for Airspace Control in the Combat Zone*. This upheld the right of commanders who had an air command and control capability to manage their own airspace control subsectors within a joint environment. Although this document has been supplanted by a series of JCS publications, it served as leverage in future dealings with the Air Force and would ensure the integrity of Marine fighting organizations--the Marine Air-Ground Task Forces (MAGTFs). However, the most significant doctrinal growth to emerge in the area of command and control of MAGTF aviation was the 1986 Omnibus Agreement (38:OMNIBUS). Signed on 4 March 1986 by the Joint Chiefs of Staff and incorporated into JCS Publications, the agreement set forth policy for command and control of Marine tactical aviation during sustained operations ashore. Highlights of that agreement are listed below:

- The MAGTF commander will retain operational control of his organic air assets.

- The primary mission of the MAGTF air combat element is the support of the MAGTF ground element.
- During joint operations, the MAGTF air assets will normally be in support of the MAGTF mission.
- The MAGTF commander will make sorties available to the joint force commander, for tasking through his air component commander, for air defense, long-range interdiction, and long-range air reconnaissance.
- Sorties in excess of MAGTF direct support requirements will be provided to the joint force commander for tasking through the air component commander for the support of other components of the joint force, or of the joint force as a whole.
- Nothing shall infringe on the authority of the theater or joint force commander, in the exercise of operational control, to assign missions, redirect efforts (e.g., the reapportionment and/or reallocation of any MAGTF tacair sorties when it has been determined by the joint force commander that they are required for higher priority missions), and direct coordination among his subordinate commanders to insure unity of effort in accomplishment of his overall mission, or to maintain the integrity of the force.

In summary, the ground work had finally been established, reinforcing the Marine Corps' right to manage its own aviation assets and subsequently reinforcing the vital role that the MACCS would continue to play in the future support of MAGTF operations.

Operationally, the MACCS continued to make significant strides in technological innovation and advancements. During *SOLID SHIELD* 1974, data was correlated and exchanged between the Air Force Tactical Air Control System (TACS) and the MACCS over a new point-to-point link called Tactical Digital Information Link B (TADIL B). This same information was also converted for passage through the Navy Tactical Air Control System (NTACS). This would be the first computer-generated data exchange between

service component's air command and control systems (14:11).

Another first during the seventies was the development of a NATO data link interface. Although initially beset by interoperability problems, the MACCS would eventually be able to interface with agencies of NATO Air Defense of the Ground Environment (NADGE).

Organizationally, the MACCS would be strengthened by the addition of the Forward Area Air Defense Battery (FAAD) which would come into existence in 1969. The FAAD battery contained the shoulder-fired *REDEYE* missile that gave the MAGTF commander a badly needed point defense weapon. From 1969-71 the FAAD batteries (one in each wing) each cadred into a single platoon. By 1984 each cadred platoon became a full battery. Presently, each MACG possesses one Low Altitude Air Defense Battalion (LAADBn), each battalion consisting of six platoons grouped into two batteries. These battalions are now equipped with the much more efficient *STINGER* missile. Additionally, in 1975, Marine Air Traffic Control Squadrons (MATCS) would become part of the Marine Air Control Group (MACG). Each squadron would be capable of providing continuous, all-weather air traffic control services for three expeditionary airfields. In 1986 they would field the Marine Air Traffic Control and Landing System (MATCALS). This system provides a semi-automated terminal air traffic control capability for control of high volume traffic within minimum weather and visibility conditions. They were also equipped to provide the Marine Remote Area Approach and Landing System

(MRAALS) for control in remote locations.

With the addition of these two units, each MACG is organized to include one Headquarters and Headquarters Squadron (H&HS), one Marine Wing Communications Squadron (MWCS), one Marine Air Support Squadron (MASS), two Marine Air Control Squadrons (MACS), one Marine Air Traffic Control Squadron (MATCS), one Light Antiaircraft Missile Battalion (LAAMBn), and one Low Altitude Air Defense Battalion (LAADBn).

Within this interim period, the MACCS continued to flourish and keep pace with the forward presence and crisis response pillars of our national strategy. The MACCS remained deployable at all levels of task organization from Special MAGTFS to Marine Expeditionary Units (MEUs); Marine Expeditionary Brigades (MEBs); and Marine Expeditionary Forces (MEFs). There has been special emphasis placed on light, mobile agencies that leave a smaller footprint for embarkation without substantially decreasing capability.

All Marine Aircraft Wings (MAWs) have been active in refining procedures and honing skills to support the wide spectrum of possible MAGTF contingencies. As an example, within 2d MAW much has been done to provide air command and control capability at the lower end of the spectrum or MEU level. With each of the three MEUs that deploy under the auspices of FMFLant there is a MACG detachment whose mission is to provide the aviation combat element commander with the personnel and equipment to control aircraft and missiles. It consists of 5

officers and 25 enlisted Marines representing most of the organizations within the MACG. Although not equipped to provide long-term air command and control, they are capable of providing that control necessary for MEU-sized contingencies. Within this interim period, MACG detachments performed with distinction in several operations to include *URGENT FURY* (Grenada) and operations off the coast of Beirut among others.

During this time period the MACCS continued to refine its organizations, trained continuously, and generally readied itself for any contingency. As the Marine Corps solidified its position concerning the command and control of its own aviation assets, the MACCS also reinforced its own capability to support the effort. Very soon the MACCS would, once again, be put to the test--this time in Southwest Asia.

CHAPTER VIII

OPERATION DESERT SHIELD AND DESERT STORM

On 2 August 1990, before dawn, Iraq invaded Kuwait. For the next several months, U.S. forces under U.S. Central Command (USCentCom) established themselves in Southwest Asia, first to defend the Arabian Peninsula against further aggression as part of *OPERATION DESERT SHIELD* and second to prepare for a massive counterstroke to liberate Kuwait in *OPERATION DESERT STORM*. Marine Forces Central Command (MarCent) consisted of the First Marine Expeditionary Force (I MEF). The aviation combat element (ACE) of I MEF was a large command. Built around the Third Marine Aircraft Wing (3d MAW), the ACE quickly assembled units from all three active Marine aircraft wings, the 1st Marine Expeditionary Brigade (1st MEB), and the 4th (Reserve) MAW. It included not only aircraft, but also antiair defense battalions and a sizeable air command and tactical air control element (16:44).

As in past joint service endeavors, the subject of a single theater commander for air, or Joint Force Air Component Commander (JFACC), surfaced again. This would be the first real test of the "Omnibus Agreement."

Although "JFACC" became official Joint Chiefs of Staff terminology in the mid-1980s, old tensions between the services over control of theater air power were not completely resolved. The Marine Corps agreed to make sorties available to the JFACC for air defense, interdiction and reconnaissance, but the Marines would give up their direct support sorties to JFACC control only after Marine requirements had been met (17:146).

As it would turn out, the JFACC concept during the Gulf War worked reasonably well. Lieutenant General Royal N. Moore, I MEF ACE Commander, described it this way:

When reasonable men come to a course of action, they can work out reasonable solutions. Yes, it wasn't always right with doctrine on either side, but we made it work. The JFACC process...does not respond well to a quick action battlefield. If you're trying to build a war for the next 72 or 96 hours, you can probably build a pretty good war. But if you're trying to fight a fluid battlefield like we were on, then you need a system that can react. The JFACC process can't do that if you're talking command. If you're talking about...coordination...then that's exactly what the process did out there on the battlefield (18:63-70).

The MACCS that supported MarCent and interfaced with the JFACC during the Persian Gulf War was rapidly employed in locations throughout Saudi Arabia and Bahrain. Present in theater was Marine Air Control Group-38 consisting of Headquarters and Headquarters Squadron-38 (H&HS-38), which provided both a primary and a helicopter Tactical Air Command Center (TACC/HTACC); Marine Wing Communications Squadron-38 (MWCS-38)(-), which provided all of the communications connectivity for the wing; Marine Air Control Squadron-2 (MACS-2), which provided air defense control and surveillance; 2d Light Antiaircraft Missile Battalion (2d LAAMBn), which provided medium altitude surface-to-air missile capability; 3d and 2d Low

Altitude Air Defense Battalion (3d LAADBn and 2d LAADBn[-]), which provided shoulder fired surface-to-air missile capability; Marine Air Support Squadron-3 and 1(-) (MASS-3 and MASS-1[-]) as well as MASS-6 augmentees, which provided direction of air operations directly supporting ground operations; and Marine Air Traffic Control Squadron-38 (MATCS-38)(-), which provided approach control and ground controlled approach control capabilities as well as navigational aids (NAVAIDS). Although not present in unit-size numbers, there were also personnel from MACG-18 from 1st MAW in Okinawa in theater as augmentees to the various agencies.

Also in the Persian Gulf was the largest American amphibious force since the Korean conflict. Marine Forces Afloat (MFA), under Naval Forces Central Command (NavCent), consisted of the 4th and 5th Marine Expeditionary Brigades (MEBS) and the 13th Marine Expeditionary Unit (MEU). All together the MFA totaled 31 ships, 17,800 Marines, 39 tanks, 96 mobile TOW antitank missile launchers, 112 assault amphibians, 30 light armored vehicles, 52 howitzers, and 63 attack aircraft. The ACE for this force was Marine Aircraft Group-40 (MAG-40) and the MACCS that supported it was manned by a H&HS-28 detachment which provided the TACC; a MWCS-28 detachment which provided the communications connectivity for the ACE; a MASS-1 detachment and small MASS-3 detachment which provided a Direct Air Support Center (DASC) for direction of air operations in direct support of ground operations as well as an Air Support Radar Team (ASRT) which provided all-weather,

day or night, ground-controlled bombing; a MACS-6 detachment for antiair warfare control and surveillance; 3d LAAMBn(-) for medium, surface-to-air weapons capability; a battery from 2d LAADbn and a small detachment from 3d LAADbn for shoulder-fired surface-to-air weapons capability, and a detachment from MATCS-28 for approach control. It is significant to note that as the war progressed, some of these organizations were sent ashore to support MarCent forces. Those that went ashore were the H&HS-28 detachment, the 3d LAAMBn(-), the MACS-6 detachment and the MASS-3 detachment.

Within the framework of JFACC, the MACCS was able to provide outstanding air command and control from the very beginning. Linked electronically with all higher and adjacent agencies, the MACCS controlled all aircraft within its high density airspace control zones (HIDACZ) during both operations.

The employment of the MACCS was not without innovation. Prior to *DESERT SHIELD* becoming *DESERT STORM*, the ACE created a helicopter TACC (HTACC) at the Lonesome Dove expeditionary airfield (constructed in a matter of days) in order to provide command and control of helicopters near the Kuwait border. The HTACC would have much the same capability as the primary TACC located at Jubail. It was manned by both H&HS-28 and H&HS-38 personnel and was equipped with complete data link so as to follow the progress of the air war. This system, although not without its problems, worked quite well, especially during the actual assault into Kuwait.

As the assault unfolded, so did the airspace over the force, and the rapid movement of I MEF forces through the breach also necessitated some innovation. Due to the anticipated high mobility of the maneuvering divisions, the ACE commander decided to have a corps-level DASC collocated with I MEF and Air Support Liaison Teams (ASLTs) collocated with the division Fire Support Coordination Centers (FSCC). These ASLTs (called Air Support Elements [ASE] during Desert Storm) would electronically tie in with the DASC and would provide the mobility that the relatively less mobile corps-level DASC did not have.

There was also an airborne DASC manned by MASS-1 and MASS-6 personnel that functioned as an airborne command and control center (ABCCC) and as an extension of the DASC. The ABCCC (an Air Force term) was used to coordinate the airspace and the flow of aircraft for deep air support and close air support missions.

The airborne platform maintained constant communications with both 1st and 2d Marine Divisions, relaying Joint Tactical Air Requests, Assault Support Requests, Medevac Requests, and battlefield intelligence, as well as augmenting external coordination between the DASC the USAF ABCCC. The airborne DASC was prepared to assume control of limited DASC functions during ground DASC displacements and/or casualty situations. Major functions of the airborne system, during deep air support missions, included coordinating Fast FACs (in F/A-18Ds) and strike aircraft to conduct immediate counter battery operations, coordinating strikes on I MEF/TACC priority targets such as artillery and armor positions, and when directed, diverting aircraft to immediate targets identified by I MEF/TACC (6:MASS).

2d and 3d LAAMBn provided vital area defense for the airfields near the border while 3d LAADBn and elements of 2d LAADBn accompanied each battalion assault team. MATCS-38 was located at the principal Marine airfields throughout Saudi Arabia

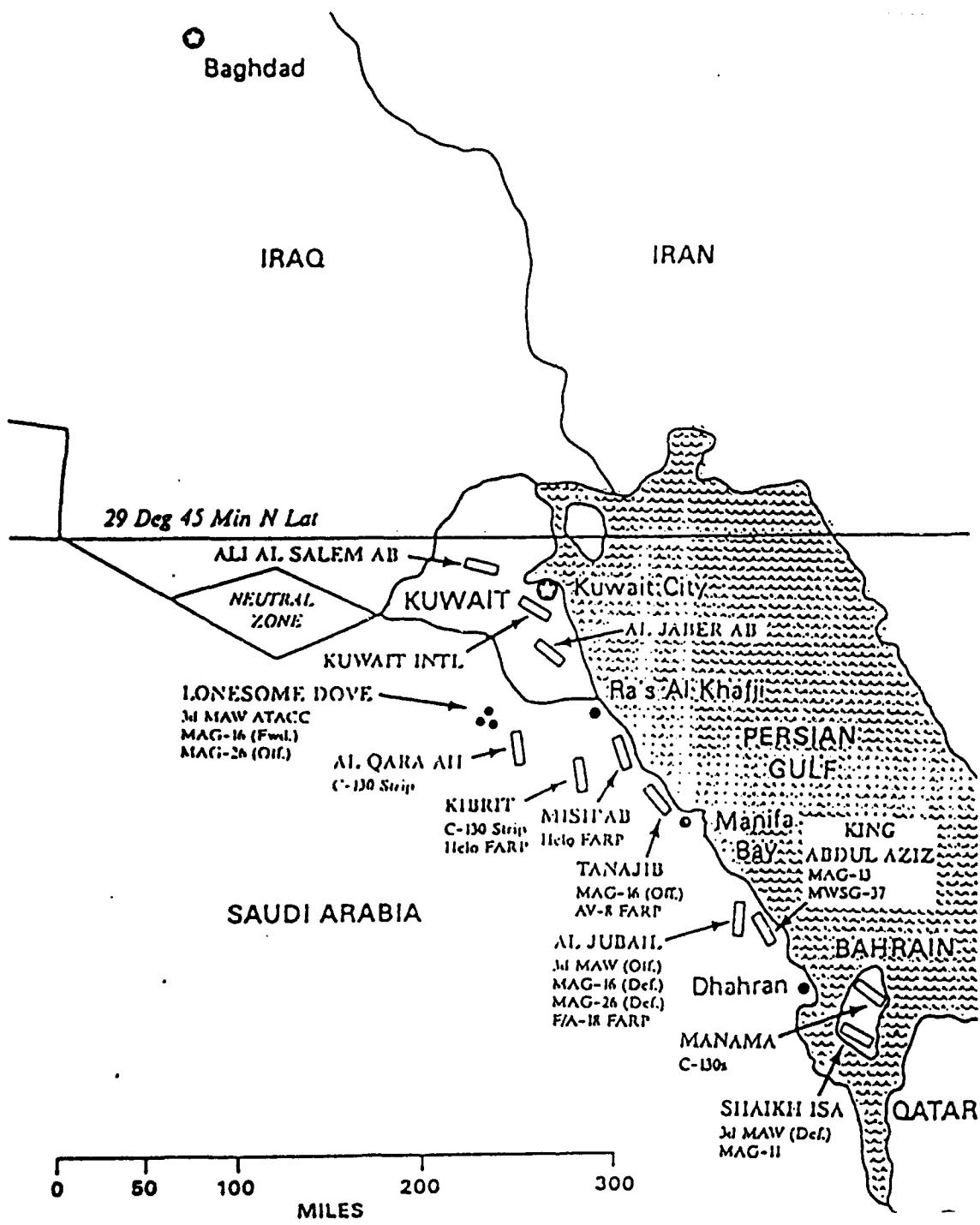
and would eventually move forward to restore and provide full approach control services to Kuwait International Airport until civilian authorities took it over a month later. Providing a radar umbrella over the force were the TPS-32 AND TPS-59 radars from MACS-2 and 6.

In what was perhaps the quickest embarkation of any MAGTF of brigade size in history, the 4th MEB departed in three transit groups arriving in theater about a month later. After arriving, the task force began preparations for what was to be *OPERATION DESERT SABER*--the amphibious assault. In preparation for that event, the task force conducted several amphibious rehearsals including the four *SEA SOLDIER* exercises in Oman and the *IMMINENT THUNDER* exercise held in Saudi Arabia. During these evolutions the MACG detachment exercised and refined air command and control procedures with the Navy's Tactical Air Control Squadron (TACRON). The phasing ashore of air support control was given the most attention as was the conducting of ASRT missions.

The concept of air support liaison teams (ASLTs) also received considerable attention during amphibious operations. Supporting the equivalent of two regimental landing teams (RLTs), the DASC found its ability to move as rapidly as the RLTs not within its capability. Although mobile, it could not dismantle and reassemble fast enough to keep up and still maintain electronic connectivity with the amphibious task force afloat. To compensate, MASS-1 developed two ASLTs consisting of 2 officers and 7 enlisted personnel each mounted in communications

vehicles that would be capable of collocating with the highly mobile forward elements of the regiments. The DASC would remain with the 4th MEB fire support coordinators and would displace at a much slower pace. When displacing, one of the ASLTs would be "plussed up" to echelon level and become the DASC until it could relocate. Although the majority of the MACCS with the amphibious task force was never used in combat, it was prepared to do so. If it had, the DASC would have provided I MEF with another ASE or would have been absorbed into the airborne or ground DASC structure while the other MACCS elements would have also been absorbed into 3d MAW.

In summary, the Omnibus Agreement held up reasonably well and the MACCS ensured that Marine aviation was properly commanded and controlled by Marines within its assigned sector. Moreover, the Persian Gulf War proved that the services, although not without some pain, could accommodate the unique aspects of the other when it came down to executing the mission and getting the job done.



CHAPTER IX

MACCS IN THE CURRENT WORLD ENVIRONMENT

As was mentioned in the two previous chapters, the issue of who was to command and control Marine aviation in a joint environment, although by no means completely settled, was finally beginning to come into focus in favor of the Marine Corps. On 23 November 1992, the Chairman of the Joint Chiefs of Staff, General Colin Powell, issued a Chairman's Memorandum entitled *A Doctrinal Statement of Selected Joint Operational Concepts*. Its purpose was to provide his concepts on the development of future joint doctrine. In the document, the Chairman cautioned the Joint Force Commander stating that while centralization of certain functions may be valuable, reducing the versatility, responsiveness, and initiative of subordinate forces should be avoided. He also cautioned the joint force commander to allow service tactical and operational assets and groupings to function as designed, i.e. maintain the integrity of service organizations (including the MAGTF) (19:8-9). The Marine Corps has come a long way towards being recognized for the unique organization it is but must continue to view the future with caution.

Since *DESERT STORM*, the MACCS has continued to flourish.

Nearly concurrent with activities in the Persian Gulf, MACCS elements continued to be deployed world-wide. *OPERATION PROVIDE COMFORT*, an effort to aid the Kurds in Turkey and Northern Iraq, is a good example of the current and future types of missions in which the Marine Corps can expect to participate. While in support of the 24th Marine Expeditionary Unit, Special Operations Capable (MEU) (SOC), the Marine Air Control Group-28 Detachment proved vital to the operation as they controlled and directed over 2722 armed reconnaissance missions and close air support sorties for all services involved in addition to 47 medical evacuations. They also provided airfield control until replaced by USAF units. During their time in theater, they far exceeded what was expected of them by conducting 54 days of sustained, around-the-clock air support control (6:MASS). This is typical of the versatility and efficiency that a task organized MACCS can provide the MAGTF commander.

Doctrinally speaking, the MACCS is adjusting well to the dictums outlined in the new "From the Sea Strategy" which moves the Navy closer to shore rather than fighting the deep sea battle. Actually, the MACCS is already well suited to conduct littoral warfare as that has been the regime of the Marine Corps since its earliest days. Over-the-horizon (OTH) operations, a characteristic of this type of warfare, will present some communications challenges but the MACCS has already proven itself capable of functioning well in amphibious operations and will continue in the future.

Organizationally, the units within the MACGs have felt the pinch that the current force restructuring measures have brought. There have been consolidations and casualties that have occurred but the MACCS is still fully functional as a participant of a forward presence or crisis response force. As of this writing, the following constitute the units of a MACG:

- Marine Tactical Air Command Squadron (MTACS), formerly Headquarters and Headquarters Squadron (H&HS).
- Marine Wing Communications Squadron (MWCS)
- Marine Air Support Squadron (MASS), minus its Air Support Radar Teams (ASRT)
- (2) Marine Air Control Squadrons (MACS)
- Low Altitude Air Defense Battalion (LAADBN)
- Light Antiaircraft Missile Battalion (LAAMBn)
- Marine Air Traffic Control Squadron (MATCS)

Changes that are expected in the near-term future are the incorporation of MATCS into the MACS and the consolidation of all the LAAMBns into one large LAAM organization to be located at Yuma, Arizona.

New equipment either has been or is currently being fielded to improve the MACCS ability to provide command and control. The TACC will begin to operate out of a new Advanced Tactical Air Command Center (ATACC) which will consolidate most of the hardware into a smaller, more mobile configuration. The MASS has fielded an Improved Direct Air Support Center (IDASC) which has already been battle-tested in *DESERT STORM* and has "mothballed" its ASRTs due to improvements in aircraft bombing systems. The

MACs is also becoming modularized so as to increase its mobility and flexibility. They are now operating in the new Tactical Air Operations Module (TAOM). There are numerous ongoing projects being conducted to improve the MACCS efficiency. All of these advancements will ensure ability of the MACCS to support MAGTFs in any future contingencies.

This paper illustrated through historical perspective how the Marine Air Command and Control System mission evolved into the vital role it plays in today's Marine Corps. In the interest of brevity (and in some cases clarity) certain segments of the MACCS colorful past have been selectively omitted. Their importance in history, however, should not be diminished. The MACCS has been around a long time and has evolved through some trying times. Much can be said along the same lines for the Marine Corps in general. Thanks to the foresight of our leaders and the innovators, the MACCS will continue to grow and evolve to provide that vital link between the air and the ground.

GLOSSARY

- AA.....Antiaircraft
- AAOC.....Antiaircraft operations center. Operations centers that enabled LAAMBns to control their batteries and interface with higher/adjacent agencies.
- ABCCC.....Airborne battlefield command and control center. USAF aircraft equipped to act as an airborne command post or communications and intelligence relay.
- ACE.....Aviation combat element. One of the four MAGTF elements. Provides MAGTF with aviation platforms and the means to control them.
- ADC.....Air Defense Command. Established by Tactical Air Force, Tenth Army to provide air defense C² ashore during battle for Okinawa.
- ADCC.....Air defense command center. Facility from which the ADC operated.
- ALPS.....Air liaison parties. Forerunner of the Tactical Air Control Parties. Provided mechanism for requesting and controlling close air support.
- ASE.....Air support elements. Element task organized by Marine Air Support Squadron to perform various air support control functions for the Marine Expeditionary Units.

- ASLT**.....Air support liaison team. Element task organized by Marine Air Support Squadron to maintain liaison between the DASC and the highly mobile ground combat element (GCE) fire support coordination centers (FSCC).
- ASP**.....Air support parties. Forerunner of the USAF Tactical Air Control Party concept. They were forward fighter control teams.
- ASRT**.....Air support radar teams. Ground-based radar used for providing all-weather, day/night precision bombing.
- ATACC**.....Advanced tactical air command center. Improved, more mobile version of the TACC.
- ATDS**.....Airborne tactical data system. Airborne early warning system capable of disseminating tactical information via tactical digital information links.
- AWS**.....Air warning squadron. Agencies established in WWII which provided surveillance and ground control to airborne fighter aircraft. Forerunner of the Marine Air Control Squadron.
- CAOC**.....Counterair operations center. Agency providing decentralized control of air defense. Forerunner of Tactical Air Operations Center.
- CAP**.....Combat air patrol. On station aircraft used in a counterair role.
- CincPac**.....Commander in Chief, Pacific.
- ComUSMACV**.....Commander, United States Military Assistance Command, Vietnam.
- CRC**.....Control and reporting center. Element of USAF tactical air control system. Provides radar control and warning.

DASC.....Direct air support center. Element of MACCS. Provides control and direction of close air support and other tactical air support missions. Under the operational control of the TACC.

FAAD.....Forward area air defense. FAAD batteries provided point air defense capability using the REDEYE missile.

FAC.....Forward air controller. Officer member of the tactical air control party who, from a forward ground or airborne position, controls aircraft in close support of ground troops.

FMFLant.....Fleet Marine Forces, Atlantic

FMFPac.....Fleet Marine Forces, Pacific

FSCC.....Fire support coordination center. A single location in which all forms of fire support are coordinated.

GCA.....Ground control approach. Positive radar control of aircraft usually conducted during periods of reduced visibility to assist aircraft in landing.

GCI.....Ground controlled intercept. Positive radar control of aircraft during the conduct of a counterair mission.

H&HS.....Headquarters and headquarters squadron. In a Marine Air Control Group, formerly the unit that provided administrative functions for the group staff as well as the people and equipment for the Tactical Air Command Center.

HTACC.....Helicopter tactical air command center. Agency created to centralize command and control of forward operating helicopters during OPERATION DESERT STORM.

HIDACZ.....High density airspace control zone.
Designated airspace in which there
is a concentrated employment of
numerous and varied weapons and
airspace users.

IDASC.....Improved direct air support center.
More mobile and capable DASC.
Designed principally for larger
MAGTF operations.

IFF.....Interrogation, friend or foe. A
system using electromagnetic trans-
missions to which equipment carried
by friendly forces automatically
responds, thereby distinguishing
themselves from enemy forces.

JOC.....Joint operations center.
Established by the Eighth Army and
Fifth Air Force during the Korean
conflict for the purpose of
coordinating air-ground operations.

LAADBn.....Low altitude air defense battalion.
Component of the MACG. Provides
point air defense for the MAGTF
using the surface-to-air Stinger
missile system.

LAAMBn.....Light antiaircraft missile
battalion. Element of the MACG.
Provides medium altitude surface-
to-air missile defense. Uses Hawk
missile.

LFASCU.....Landing force air support control
unit. First established in WWII,
these units provided decentralized
close air support control and
coordination for ground units.
Forerunner of the DASC.

MACCS.....Marine air command and control
system. System which provides the
ACE commander with the means to
command, control, and coordinate
all air operations in an assigned
sector and to coordinate air
operations with other services.

MACS.....Marine air control squadron.
Element within the MACG responsible
for the decentralized control of
air defense for the MAGTF.
Provides the TAOC.

MACG.....Marine air control group. Element
of the Marine aircraft wing that
has the personnel and equipment
required to run the MACCS.

MAG.....Marine aircraft group. A
subordinate element of a wing
usually consisting of aircraft and
maintenance squadrons.

MAGTF.....Marine air-ground task force. Task
organized warfighting element of
the Marine Corps. Consists of a
command element, an aviation combat
element, a ground combat element,
and a combat service support
element.

MarCent.....U.S. Marine Forces Central Command.
Marine component commander under
U.S. Central Command.

MASRT.....Marine air support radar team.
Ground-controlled precision bombing
system developed prior to the
Korean conflict. Predecessor of
the ASRT.

MASS.....Marine air support squadron.
Element of the MACG. Responsible
for the decentralized coordination
and control of close air support.
Provides the DASC.

MATCALS.....Marine air traffic control and
landing system. Provides
continuous radar approach,
departure, and enroute air traffic
control capabilities for an
airfield. Provided by the MATCS.

MATCS.....Marine air traffic control
squadron. Element of the MACG.
Provides air traffic control
capability for expeditionary
airfields and remote landing sites.

MATCU.....Marine air traffic control unit.
Forerunner of the MATCS.

MAW.....Marine aircraft wing. Is the ACE
for a MEF. There are three active
and one reserve Marine aircraft
wings in the USMC.

MEB.....Marine expeditionary brigade.
MAGTF task organized normally with
an aircraft group, a regimental
landing team and a brigade service
support group as well as a brigade
headquarters.

MEF.....Marine expeditionary force. MAGTF
task organized normally with a
wing, a division and a force
service support group as well as a
MEF headquarters.

MEU.....Marine expeditionary unit. MAGTF
task organized normally with a
squadron, a battalion, a MEU
service support group and a MEU
headquarters.

MFA.....Marine forces afloat. Title given
to Marine amphibious forces during
OPERATION DESERT STORM. Consisted
of 4th MEB, 5th MEB and 13th MEU.

MGCIS.....Marine Ground Control Intercept
Squadron. Korean conflict pre-
decessor of the MACS.

MRAALS.....Marine remote area approach and
landing system. Component of the
MATCS. Provides portable precision
control of aircraft at remote
landing sites.

- MTACS.....Marine tactical air control squadron. In the Korean conflict, a unit within the MACG that provided personnel and equipment for the TACC as well as an air support section that sometimes deployed separately to control close air support. Presently, it provides administrative support to the MACG and personnel and equipment for the TACC, only.
- MTDS.....Marine tactical data system. Title given to USMC semi-automated digital information system in its early development stage.
- MWCS.....Marine wing communications squadron. Element of the MACG. Provides wing communications, principally to the TACC.
- MWHG.....Marine wing headquarters group. Predecessor of the Marine wing headquarters squadron.
- MWHS.....Marine wing headquarters squadron. Unit that provides the administrative support for a Marine aircraft wing.
- NADGE.....NATO Air Defense of the Ground Environment. NATO's air command and control system.
- NavCent.....U.S. Naval Forces Central Command. Navy component of U.S. Central Command.
- NTDS.....Navy Tactical Data System. Ship-based system for dissemination of tactical digital information.
- OTH.....Over-the-horizon.
- RLT.....Regimental landing team. Ground combat element of a MEB.
- SOC.....Special operations capable. Designation given to those MEUs that are qualified to conduct special missions.

TACC.....Tactical air command center.
(USMC)/Tactical air control center
(USN/USAF). In USMC, it's the
senior MACCS agency and command
post of the ACE commander. In the
USN/USAF, it is their senior air
command and control agency. The
USAF has renamed theirs an air
operations center (AOC).

TACP.....Tactical air control party. USMC
and USAF element that provides
mechanism for requesting and
controlling close air support.

TACRON.....Tactical air control squadron.
Navy unit that provides personnel
to man the Navy TACC.

TACS.....Tactical air control system. USAF
equivalent of the MACCS.

TADC.....Tactical air direction center. An
air operations installation under
the overall control of the tactical
air control center (afloat)/
tactical air command center, from
which aircraft and air warning
service functions of tactical air
operations in an area of
responsibility are directed.

TADIL.....Tactical digital information link.
A Joint Staff approved,
standardized communication link
suitable for transmission of
digital information.

TAF.....Tactical air force. Early
designation for the largest of USAF
aircraft units.

TAOC.....Tactical air operations center.
Component of the MACCS. Provides
decentralized air defense control
and surveillance under the
operational control of the TACC.

TAOM.....Tactical air operations module.
Much improved model of the TAOC.
Modularized and much more mobile.

TDCC.....Tactical data communications central. Equipment that enhanced the capability of the MTDS to store and transmit digital information.

USCentCom.....United States Central Command. Unified command responsible for the geographic region that encompasses Southwest Asia.

VMF(N).....Marine aircraft squadron designator.
V--fixed wing
M--Marine
F--fighter
(N)--night

LIST OF REFERENCES

1. Major General Vernon E. Megee, USMC "Tactical Air Support of Ground Forces," Marine Corps Gazette, 39 (December 1955): pp.12-17.
2. Brigadier General Homer G. Hutchinson, USMC, "Early Night Fighters in Marine Corps Aviation: A Part of the Beginnings," Marine Corps Gazette, May 1993, pp 68-72.
3. Robert Sherrod, History of Marine Corps Aviation in World War II. Washington: Combat Forces Press, 1952.
4. Lieutenant Colonel Kirk Armistead, USMC, Staff Study: "The Okinawa Campaign, 1 April 1945: A Study of Air Defense Control." dtd 1948, J.C. Breckinridge Library, Marine Corps Development and Education Command, Quantico, Va.
5. John A. De Chant. Devilbirds: The Story of United States Marine Corps Aviation in World War II. Washington, 1947.
6. U.S. Marine Corps. Unit Files, Lineages and Honors. Unit Files, Lineages and Honors Sections, Marine Corps Historical Center, Washington, D.C.
7. James A. Winnefield and Dana J. Johnson. Command and Control of Joint Operations: Some Lessons Learned from Four Case Studies of an Enduring Issue. Santa Monica, Ca.: Rand Corporation, 1991.
8. James A. Field Jr., History of Naval Operations in Korea, Department of the Navy, Washington, D.C., 1962.
9. Lynn Montross, et al.. The East--Central Front--U.S. Operations in Korea, 1950-1953. vol. 4. Washington: Historical Branch, G-3 Division, Headquarters, USMC, 1962.
10. Robert F. Futrell. The United States Air Force in Korea, 1950-1953, Department of the Air Force, Washington, D.C., 1981.

11. Lieutenant Colonel Pat Meid, USMC and Major James M. Yingling, USMC. Operations in West Korea--U.S. Marine Operations in Korea, 1950-1953. vol. 5. Washington: Historical Branch, G-3 Division, Headquarters, USMC, 1962.
12. U.S. Marine Corps. Headquarters U.S. Marine Corps. Landing Force Bulletin Number 9, the Marine Air Command and Control System. Washington, D.C., 1954.
13. Lieutenant General Keith B. McCutcheon, USMC. "Marine Aviation in Vietnam, 1962-1970," Naval Review 1971, Annapolis: U.S. Naval Institute. May 1971, pp. 122-155.
14. Colonel Michael P. Mulhqueen, USMC. Transcript of speech delivered at the Marine Air Command and Control Conference Dinner, Arlington, Va., January 14, 1987.
15. Jack Schulimson. "U.S. Marines in Vietnam--An Expanding War, 1966," ms., 8pts. Marine Corps Historical Center, Washington, D.C., 1982.
16. Lieutenant General Royal N. Moore Jr., USMC, "A Conversation With LtGen Royal N. Moore, Jr.," Marine Corps Gazette, October 1991, pp. 44-49.
17. Thomas A. Keaney and Eliot A. Cohen. Gulf War Air Power Survey Summary Report. Maxwell AFB: Air War College, 1993.
18. Lieutenant General Royal N. Moore Jr., USMC, "Marine Air: There When Needed," U.S. Naval Institute Proceedings, November 1991, pp. 63-70.
19. General Colin L. Powell, CJCS, memorandum to all Service Chiefs and CinCs, Subj: A Doctrinal Statement of Selected Joint Operational Concepts, dtd 23Nov92 (File No. CM-1502-92).
20. "Air Power in Korea--Ground Support," U.S. Naval Institute Proceedings, 78 (February 1952): 221-222.
21. Guy Anselmo, "Diamonds on the Wing," Leatherneck, 69 (May 1986): 24-35.
22. Master Sergeant Fred G. Braitsch Jr., USMC, "Marine Air War," Leatherneck, 34 (November 1951): 30-35.
23. Kenneth W. Condit and Ernest H. Giusti, "Marine Air Cover Over Inchon-Seoul," Marine Corps Gazette, 6 (June 1952): 18-27.

24. Kenneth W. Condit and Ernest H. Giusti, "Marine Air Covers the Breakout," Marine Corps Gazette, 36 (August 1952): 20-27.
25. Graham A. Cosmas and Lieutenant Colonel Terrence P. Murray, USMC, "U.S. Marines in Vietnam--Vietnamization and Redeployment, 1970-1971," ms., 6pts. Marine Corps Historical Center, Washington, D.C., 1986.
26. Benis M. Frank. Okinawa: Touchstone to Victory. New York: Ballantine Books Inc., 1969.
27. Andrew R. Hoehm, "Marine Air, Historical Works in Review," Marine Corps Gazette, 70 (May 1986): 101-104.
28. Lieutenant Colonel P.D. Lambrecht, USMC. Staff Study: "Employment of Night Fighter Aircraft," dtd 1948, J.C. Breckinridge Library, Marine Corps Development and Education Command, Quantico, Va.
29. Major G.D. McPherson, USMC. Staff Study: "The Transfer of Certain Marine Antiaircraft Units From Force Troops to Force Aviation," dtd 19 March 1957, J.C. Breckinridge Library, Marine Corps Development and Education Command, Quantico, Va.
30. Lieutenant Colonel R.D. Opp Jr., USMC. Staff Study: "To Determine a Concept for the Employment of the Medium Antiaircraft Missile Battalion in Support of a Marine Air-Ground Task Force During the Conduct of Modern Amphibious Warfare," dtd 25 March 1957, J.C. Breckinridge Library, Marine Corps Development and Education Command, Quantico, Va.
31. Lieutenant Colonel C.A. Phillips, USMC, "1st MAW in Korea," Marine Corps Gazette, 41 (June 1957): 20-26.
32. Lieutenant Colonel Allan G. Pixton, USMC "Close Air Support in Amphibious Operations," Military Review, 23 (August 1953): 28-34.
33. Major Gary L. Telfer, USMC, "U.S. Marines in Vietnam-- Fighting the North Vietnamese, 1967," ms., 6pts. Marine Corps Historical Center, Washington, D.C., 1984.
34. U.S. Marine Corps. Marine Corps Schools. Board to Reexamine the Adequacy of Present Concept and Mission Functions of the Marine Corps Report. An Evaluation of Air Operations Affecting the Marine Corps in World War II. 31 December 1945.

35. U.S. Marine Corps. Marine Corps Development and Education Command. Marine Aviation. FMFM 5-1, Quantico, Va.
36. U.S. Marine Corps. Marine Corps Combat Development Command. Control of Aircraft and Missiles. FMFM 5-60, Quantico, Va.
37. "Weakness in the Air Force," U.S. News and World Report, 3 November 1950, pp. 17-19.
38. General P.X. Kelly, USMC, White Letter No. 4-86, Subj: 1986 Omnibus Agreement for Command and Control of Marine Tacair in Sustained Operations Ashore. 4 March 1986.
39. Major General Harry W. Jenkins, Jr., USMC, "Desert Storm Interview," U.S. Naval Institute Proceedings, 1962, pp. 120-122.
40. Lieutenant Colonel Ronald J. Brown, USMC, "Marine Forces Afloat in Southwest Asia, 1990-1991," Marine Corps Gazette, November 1992, pp. 60-63.
41. Major William R. Cronin, USMC, "³I During the War in South Kuwait," Marine Corps Gazette, March 1992, pp. 34-37.
42. General C.E. Mundy, msg ALMAR 297/92, Subj: From the Sea, Preparing the Naval Service for the 21st Century. 1 October 1992.
43. Benjamin F. Cooling, ed. Case Studies in the Development of Close Air Support. Office of Air Force History, USAF (GPO), Washington D.C., 1990, 606 pp.
44. Major Charles D. Melson, USMC (ret), Evelyn A. Englander, Captain David A. Dawson, USMC, "U.S. Marines in the Persian Gulf, 1990-1991: Anthology and Annotated Bibliography," ms., 7pts. History and Museums Division, Headquarters, U.S. Marine Corps, Washington, D.C. 1992.
45. Lieutenant Colonel Joseph H. Elliot, USMC, Staff Study: "Development of USMC Concepts of Command and Control of Tactical Air as Compared with Present USAF Concepts." dtd 1953, Air University Library, Maxwell Air Force Base, Montgomery, Al.